

ANALYSIS OF GABOR FILTER PARAMETER FOR IRIS FEATURE EXTRACTION

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Abstract

Iris feature extraction is the important process in iris biometric system. The iris feature is extracted using the wavelet transforms. The Gabor wavelet features are widely used for the iris recognition. The existing Gabor features requires more amount of computing time. In the proposed modified Gabor wavelet the filter and the Gaussian envelop coefficients are varied to reduce the computing time. The proposed Gabor wavelet reduced the feature extraction time at average to 141 Nano seconds.

Introduction

The iris biometrics provides a unique environment as compared with the other biometrics such as retina, finger print, hand geometry, facial, ear and nose, palm, etc... The iris patterns vary for person to person, the twins are having unique iris patters and even the left and right are different. The iris portion is located in front portion of the eye.

Eye preprocessing

The eye image is captured using the digital camera. The images are captured using the specific distance and environment. The standard eye image data bases are available to test out the developed algorithms [3].

The captured or data base eye image consists of iris portion. Initially, eye image is preprocessed to locate the iris portion.

Iris Preprocessing

The iris preprocessing process is used to separate the portion of iris from the eye. The portion of eye lids and lashes are to be excluded in segmented iris. The location of iris portion in the eye is initially estimated. The proposed work concentrates on the Gabor feature extraction. The manual estimation is carried out to find the points of iris in the eye. The pixel view function is used to find the position of the iris portion[2].

Iris Cropping

The cropping is an image processing tool used to segment the specific portion the image[1]. It requires the starting position of the pixels, width and height of the image to be cropped. The iris starting pixel location, width and heights are estimated in the iris preprocessing stage.

Iris coordinate conversion

The segmented iris is in circular domain. The circular makes the rotation invariant problem. The feature loss may occur due to rotational invariant.

The above problem may solved by using the iris coordinate conversion. The coordinate conversion technique is applied to convert the circular iris in to rectangular iris.

Gabor filter

The Gabor filters are widely used in the extract the feature of the image. The Gabor filter wavelet is the form of sine wave modulated by the Gaussian coefficient. The Gabor filters are useful for extracting the global and local information's of the iris. The Gabor filters are tunable band pass filter, multiscale and multi resolution filter[7].

The Gabor filters are used in texture segmentation, documents analysis, edge detection and image coding and image representation. It offers optimal resolution in space and time domains. It provides better visual representation in the comprised texture images. But the existing gabor parameters requires more time consumption for feature extraction[8].

Parameters of Gabor Filter

The Gabor filter is based on the frequency, orientation and Gaussian kernel [6]. The gabor filter is expressed in the equ.(3) which is derived from equ.(2) equ.(1).

$$X = \exp\left(-\left(x^2 + y^2\right) \div \sigma^2\right) \quad (1)$$

$$Y = \exp\left(2\pi\theta\left(x \cos \theta + y \sin \theta\right)\right) \quad (2)$$

$$\text{Gabor}(x, y, \theta, \phi) = X \cdot Y \quad (3)$$

The terms x and y is the position of the filter relative to the input signal [5]. The angular representation of the filter is represented as ‘θ’.

The angular orientation of the filter is represented as ‘φ’. The shape of Gaussian orientation filter envelope is normally an ellipse and represented as ‘σ’. The orientation in ‘x’ and ‘y’ is equal then the shape of Gaussian frame is circle. The existing gabor filter has the filter and ‘σ’ as 5 and 0.65.

Gabor parameter selection

The existing gabor filter has the filter and ‘σ’ as 5 and 0.65 [4]. The proposed gabor parameter is used to adopt the results of existing gabor parameter without affecting the result. The proposed parameter is also to reduce the feature extraction time.

Results & Discussion

The UBIRIS Version 2.0 iris data base images are selected for testing the proposed gabor parameter.

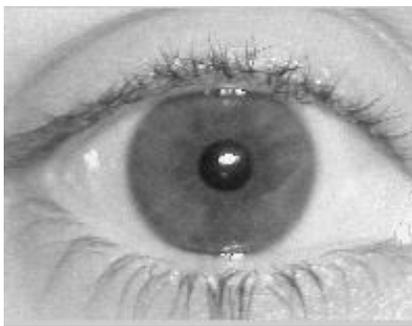


Figure 1. Input image

The selected iris image from the data base is shown in the Fig.1. The iris portion is occluded by the eye lids and lashes. The iris portion is located by eliminating the eye lashes and eye lids. The hazard free iris portion is obtained using the starting position, length and width. The starting position of the cropping boundary is located as shown in the Fig.2.

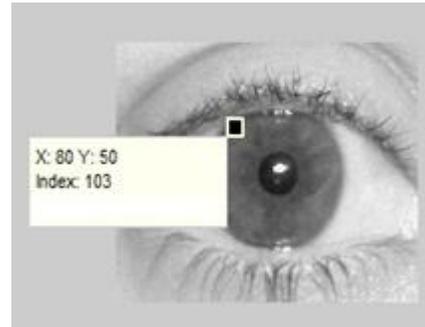


Figure 2. Cropping starting position

The width of the hazard free iris boundary is obtained as shown in the Fig.3

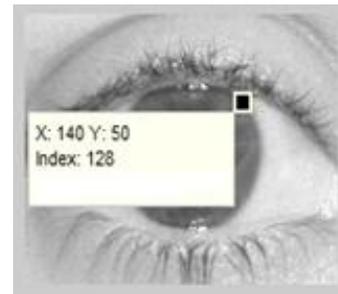


Figure 3. Cropping width position

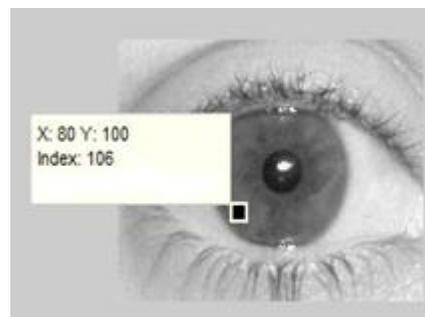


Figure 4. Cropping length position

The length of the hazard free iris boundary is obtained as shown in the Fig.4.

The cropping process is applied on the input image based on the starting position, width and length position. The obtained cropped boundary is shown in the Fig.5. It shows the hazard free iris boundary.

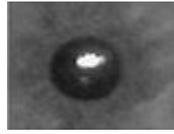


Figure 5. Cropping length position

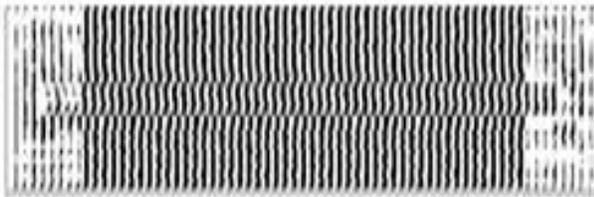


Figure 6. Rectangular iris region

The cropped iris boundary is in the circular region. The circular region causes the rotational invariant problem and the loss of pixel information. The circular iris boundary is converted in to rectangular iris boundary as shown in the Fig.6.

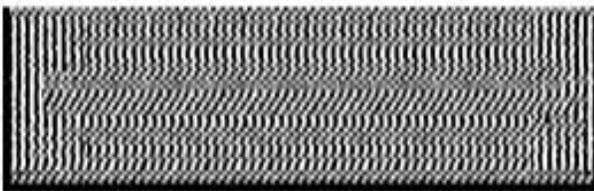


Figure 7. Existing gabor parameter

The existing gabor filter parameters are applied on the cropped input image. The sigma value as 0.65 and filter size as 5. The corresponding gabor filter result is shown in the fig.7.

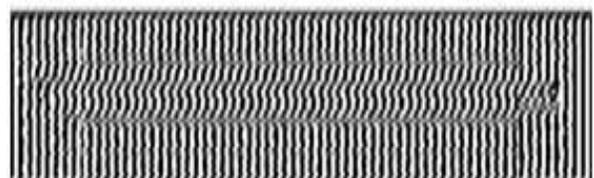


Figure 8. Modified gabor parameter

The various gabor parameters are tested using the iteration procedure. Finally, sigma and filter values are initialized as 0.2 and 2. The corresponding result is shown in the Fig.8.

In the existing gabor result, there is no valid information's near to the borders. In case of modified, the information is valid throughout the feature.

Table 1. Timing analyses

Parameters	Sigma	Filter size	Execution Time
Existing	0.65	0.5	0.88226 ms
Modified	0.2	2	0.74210 ms

The existing method takes the time delay of 0.88226ms. The proposed method takes the time delay of 0.74210ms.

Conclusion

The gabor filters plays the important role in the iris feature extraction. The existing Gabor parameters were analyzed in this paper. The existing method makes more loss of feature information and also the more time. The proposed method used the very low resources. It used the sigma value as 0.2 instead of 0.65 in the existing method and also the filter size as 0.2 instead of 5 in the existing method. The proposed gabor parameters the takes the execution time of 0.74210 ms where as the existing takes the time delay of 0.88226 ms. The proposed gabor parameters reduced the time delay of 141 Nano seconds.

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Biographies

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